Intelligent Initiation Systems

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Abstract

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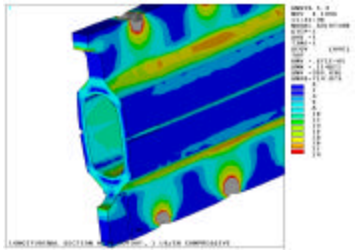
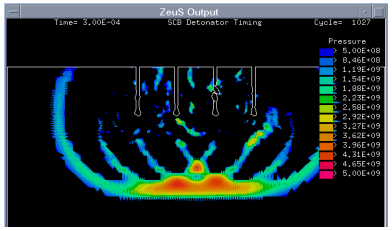
Intelligent Initiation Systems

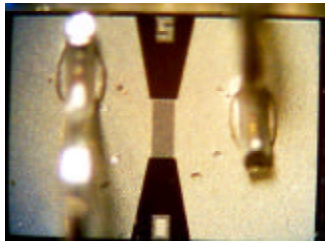


Explosive Modeling and Analysis

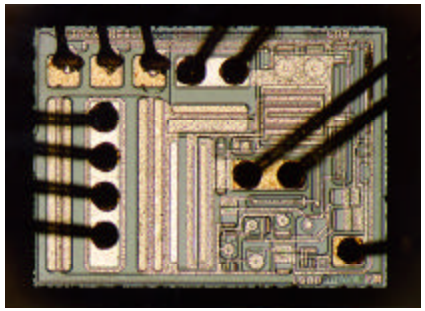


Low Energy Semiconductor Bridge

Smart Electronics



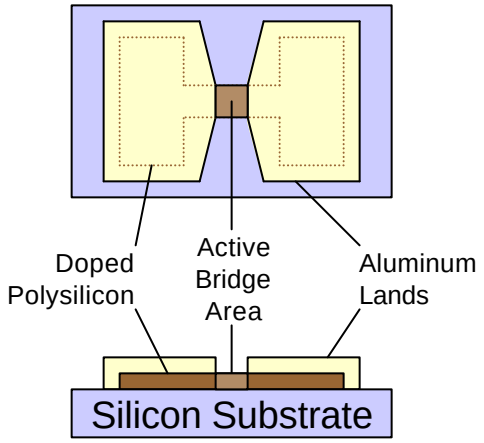
Intelligent Initiation Systems

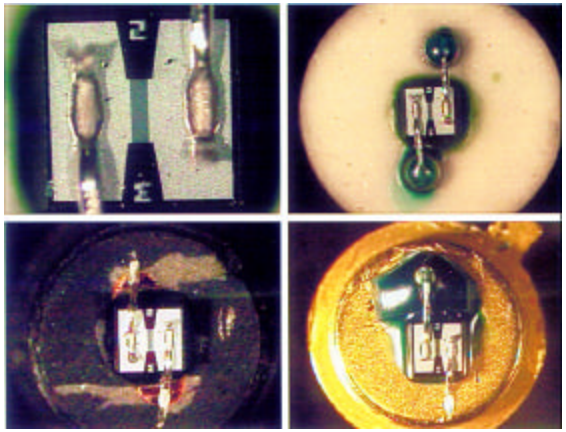


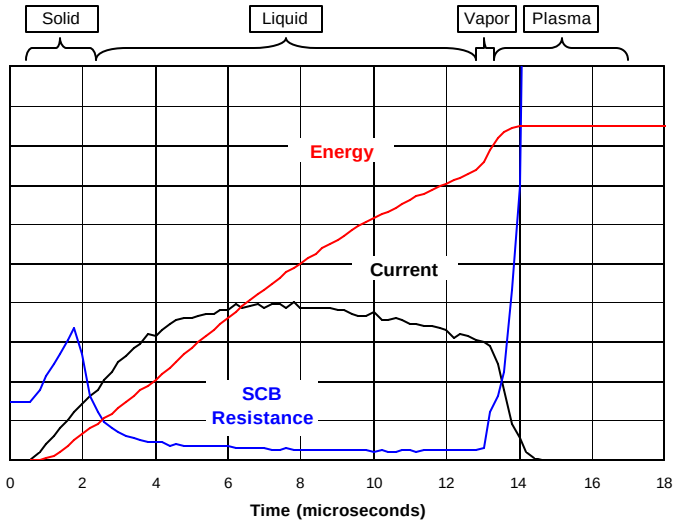
Combine Semiconductor Bridges, Explosive Modeling and Analysis, and Smart Electronics to Create A Smaller, Lighter, Lower Power, and More Capable Ordnance System

Semiconductor Bridges

- Developed By Sandia in 1987
- Fast, Low Energy Firing (<1.0mJ)
  - Energy Rate Sensitive
- Planar Design Provides High No-Fire
- Enhanced Performance SCBs Developed
  - Integrated Zener Diodes, RF Voltage Block



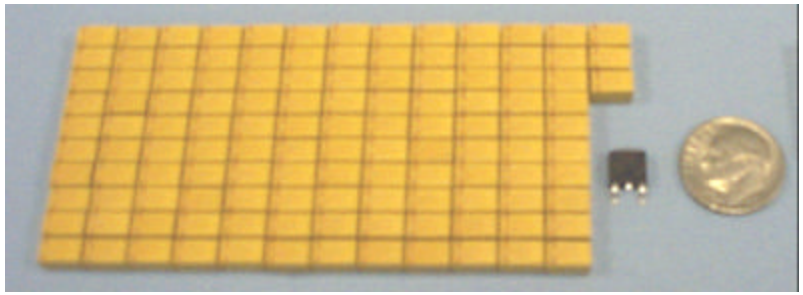




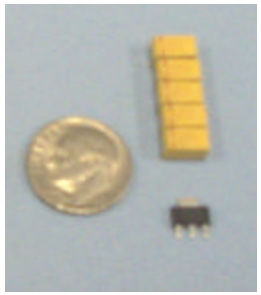
SCB Performance Data

- SCBs Provide:
  - Comparable No-Fire and ESD Performance
  - Significantly Reduced All-Fire Energy and Function Time

Bridge	No-Fire	ESD	All-Fire Energy	Function Time
HBW	1.1A	25kV, 500pF, 5k	30mJ	3ms
1st Generation SCB	1.4A	25kV, 500pF, 5k	3mJ	60µs
2nd Generation SCB	0.7A	25kV, 500pF, 150	0.3mJ	30µs
3rd Generation SCB	140V	25kV, 500pF, 5k	3mJ	30µs
Small SCB	-	-	200µJ	1.5µs



1A/1W Conventional Bridgewire Firing Capacitor Bank and Fire Switch



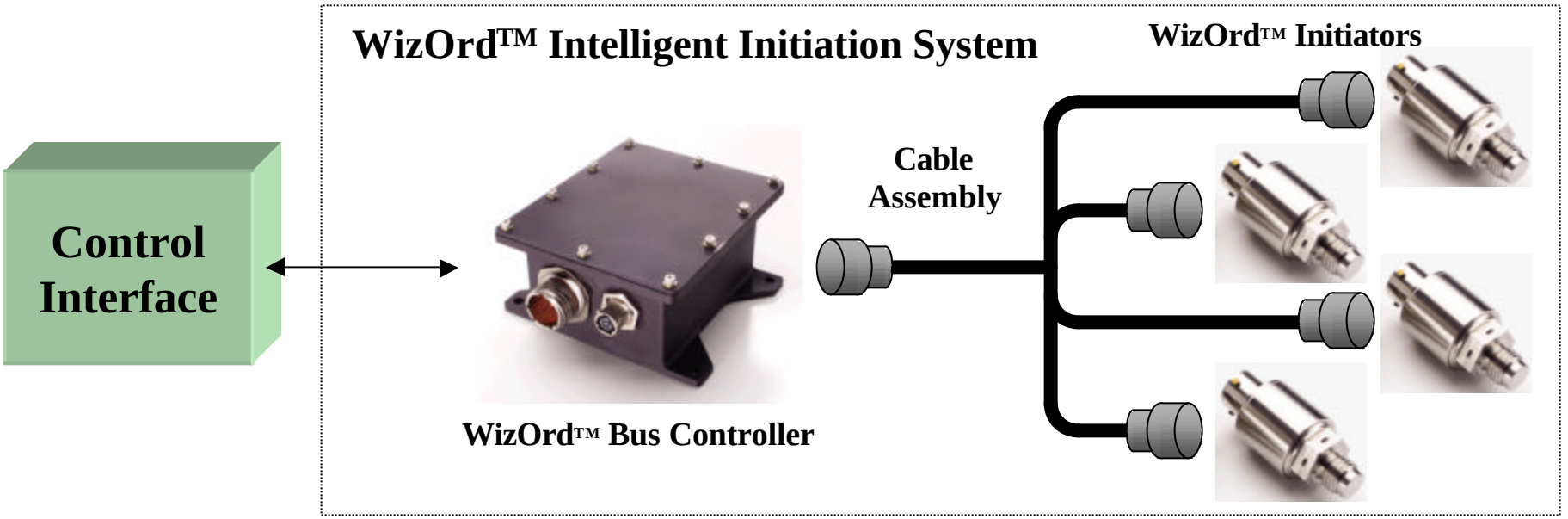
1A/1W SCB Firing Capacitor Bank and Fire Switch

WizOrd™ Intelligent Initiation System

- WizOrd™ *Intelligent Initiation System*
  - A New Paradigm in Ordnance Initiation Systems
- WizOrd™ Utilizes Smart Miniaturized Electronics to Create an Addressable Initiation System that is:
  - Smaller
  - Lighter
  - Lower Power
  - Flexible
  - More Capable

WizOrd™ System Overview

- WizOrd™ is an Addressable Party Line Initiation System
  - One Bus Controller - Multiple Initiators
  - Individually Addressable Initiators
  - Two-Way Digitally Coded Communications
  - Initiators Contain Arming and Firing Circuits
  - Simple Control Interface
    - 28VDC Power
    - 28V Discrete Arm Enable Command and Serial Control Interface



WizOrd™ Advantages

- Reduced Weight/Size
  - Bus Controller Smaller than Typical Firing Box
  - Fewer Cables
  - Power System Reduction
- Reduced Power Consumption
  - No Ordnance Firing Current Loads
- Enhanced Testability
  - Two Way Communication Bus Allows More Testability
  - Extensive Testing can be Performed in the Flight Configuration
- Flexibility
  - Initiators are Easily Added or Removed with No Controller Requal
  - Unlimited Communications - Any Initiator at Any Time
  - Intelligent Initiators Provide Flexible Protocol
- Expandable Functions
  - Bus Architecture Could Accommodate Sensors

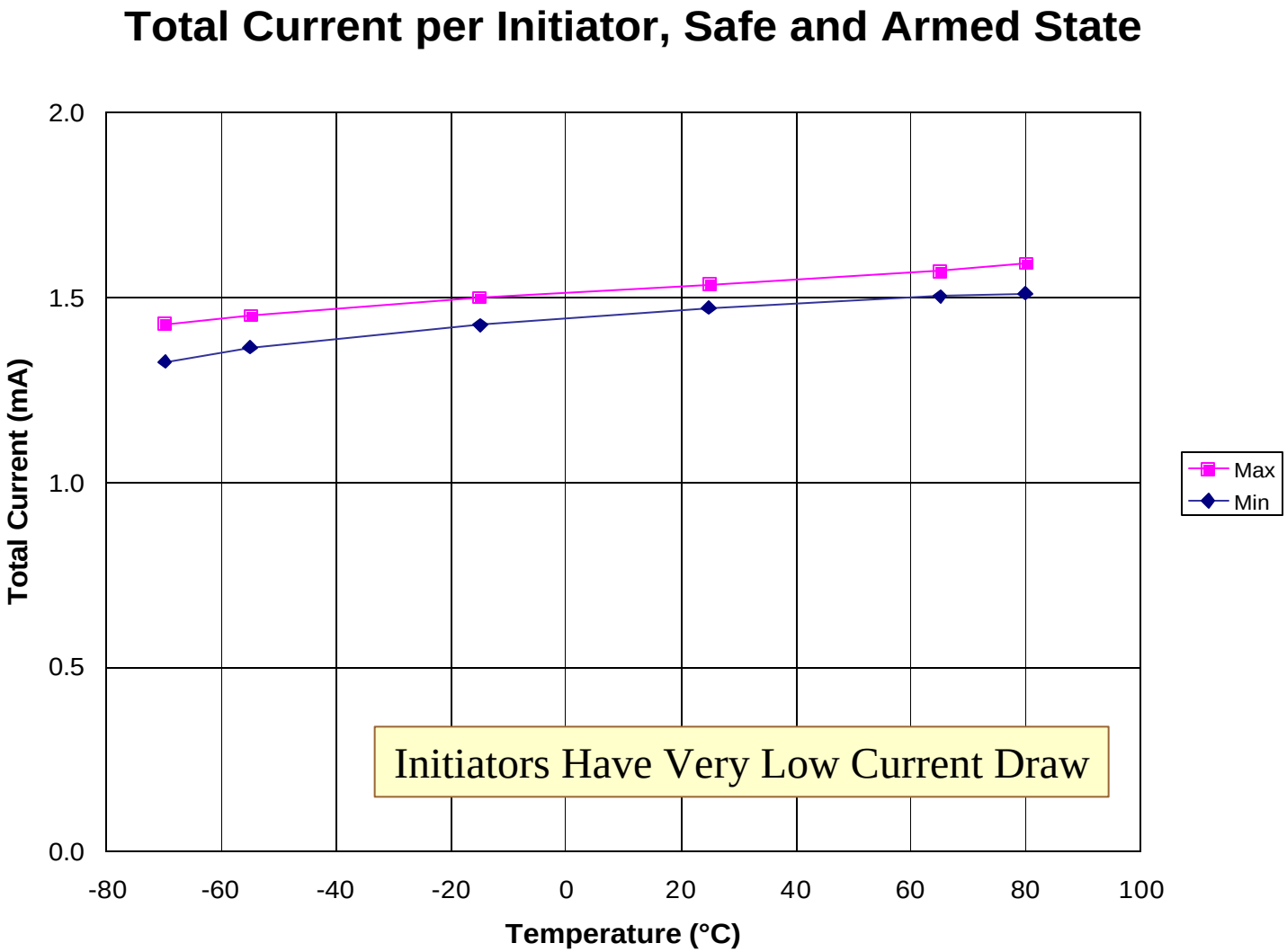
WizOrd™ Performance Data

- WizOrd™ is Designed to Meet the Requirements of:
  - MIL-STD-1512
  - MIL-STD-1576
  - MIL-I-23659
- On-Going Design Validation Test Program
  - Maximum Performance Limits Currently Being Identified
  - Stated Performance Data Represents Testing Performed to Date
- Planned System Improvements Are In Development
  - Improved Data Bus Speed
  - Detonation Output
  - Sensors
- The WizOrd™ Intelligent Initiation System Can Be Tailored for Many Applications Without Compromising Safety or Reliability

WizOrd™ Specifications

Parameter	Specification	Comments
Bus Controller Operating Voltage	22VDC to 34VDC	Can Be Re-Designed To Meet Specific Needs
Bus Controller Current Draw	60mA + 4mA per Initiator	Typically 40mA + 3mA per Initiator
Maximum Number of Initiators	124	Set By Communication Address Length
All-Fire	Minimum 2X All-Fire Energy	0.999 All-fire @ 95% Confidence Level at -65°F
No-Fire	No-Fire less than Operate Power Voltage	0.999 No-fire @ 95% Confidence Level at +160°F
EMI	Designed to MIL-STD-461	Testing in process
Charging Time	0.5 Seconds	Resistively Limited - Could Be Reduced To Meet Specific Needs
Firing Delay	4ms ± 0.25ms	Improved Bus Speed (2X) is in Development
Cable Length	Greater than 100 feet	Minimum 2X Firing Energy Margin Independent of Cable Length
Operating Temperature Range	-65°F to 165°F	Tested -90°F to 170°F
Vibration	Designed to meet typical aerospace vibration environments	Testing in process
Shock	Designed to meet typical aerospace shock environments	Testing in process
Initiator Output	NSI Equivalent (118mg ZPP)	Detonation or Other Squib Outputs Easily Accomodated
Size and Mass		
Initiator	0.8 in. dia x 1.8 in, 1.25 oz.	Can Be Re-Packaged To Meet Specific Needs
Space Bus Controller	4.5 in. x 4.0 in. 2.5 in., 1.75 lb	
Tactical Bus Controller	4.5 in. x 2.5 in. x 1.25 in., 0.5 lb	

WizOrd™ Measured Data



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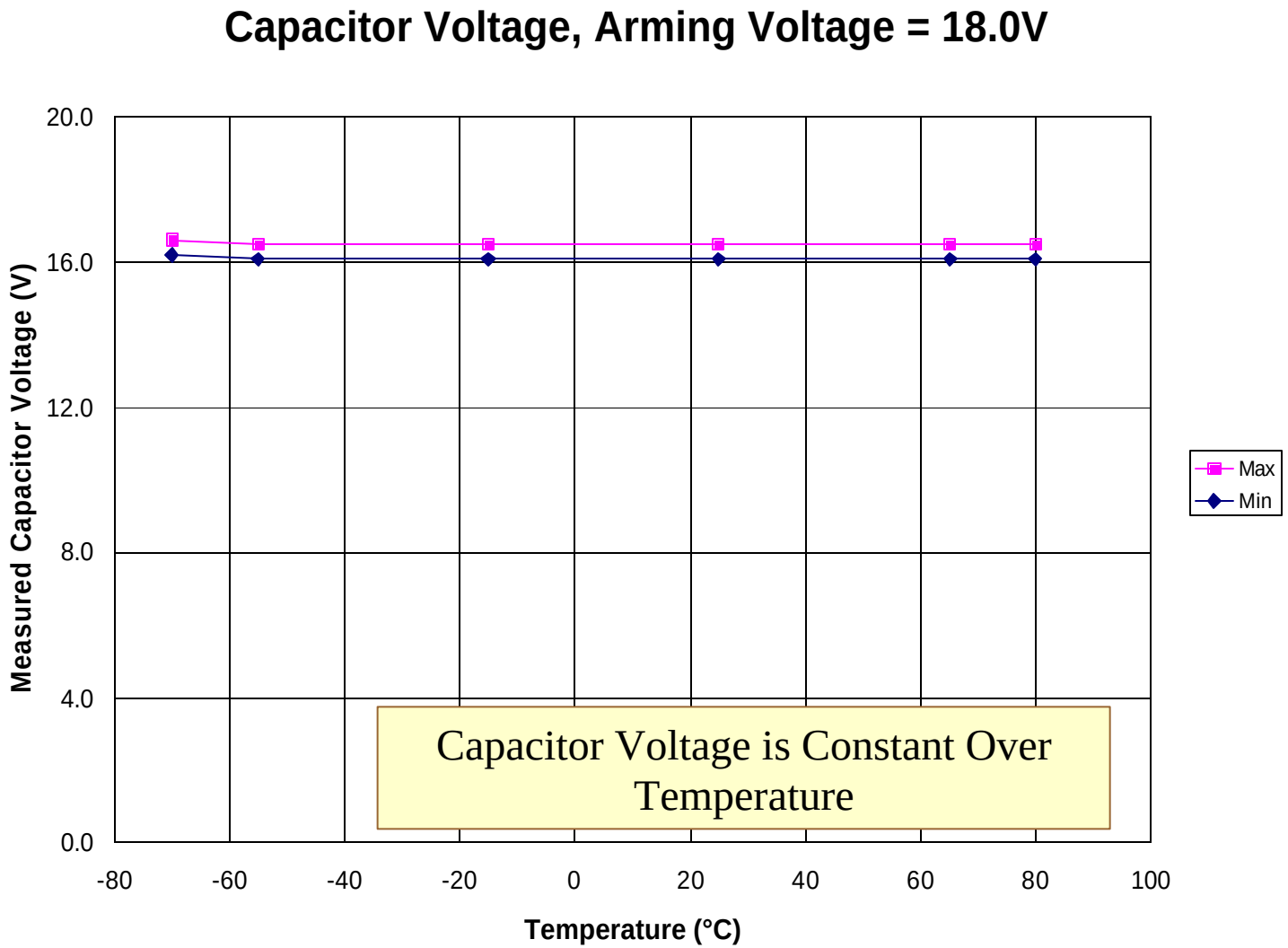

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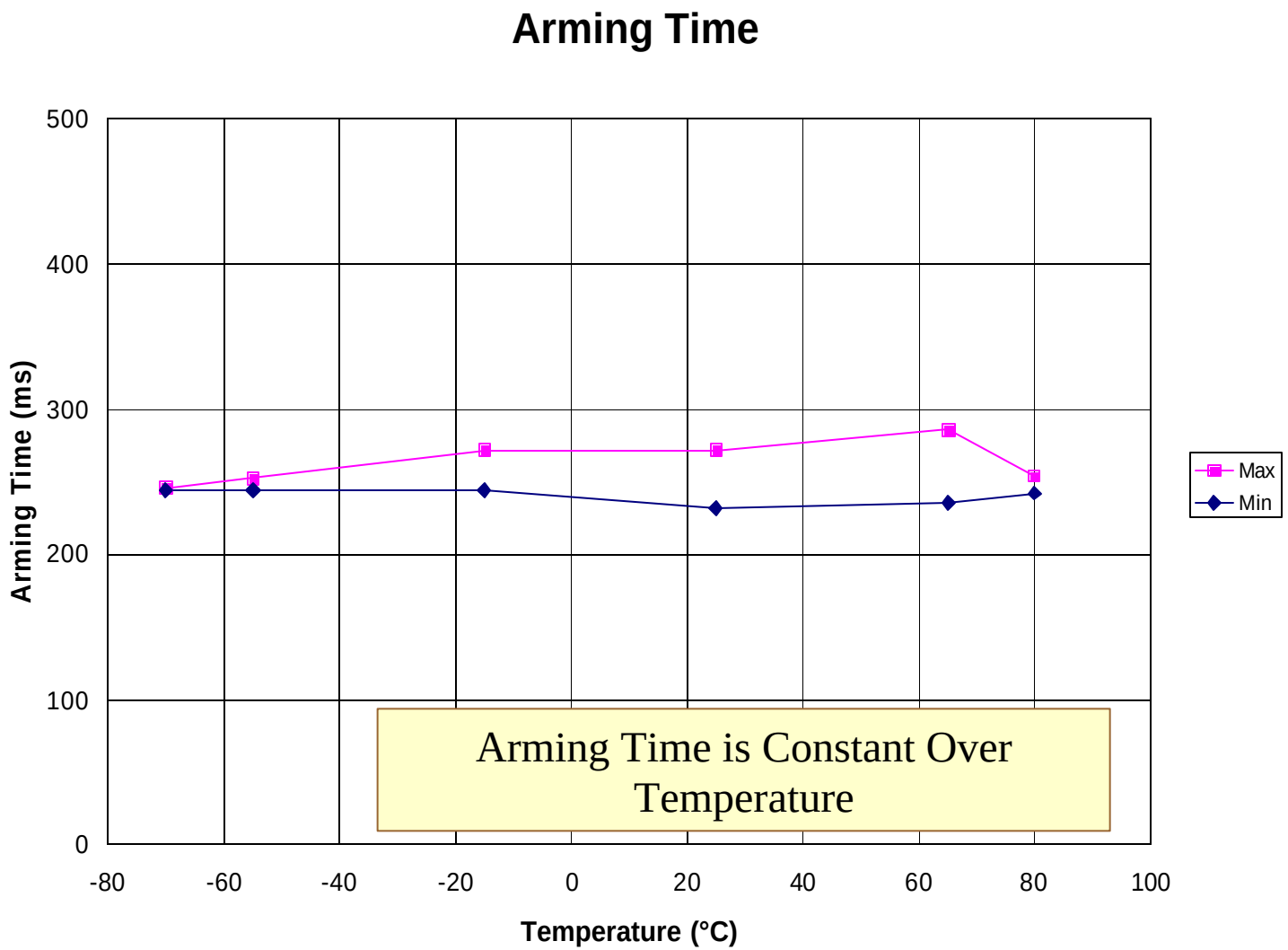

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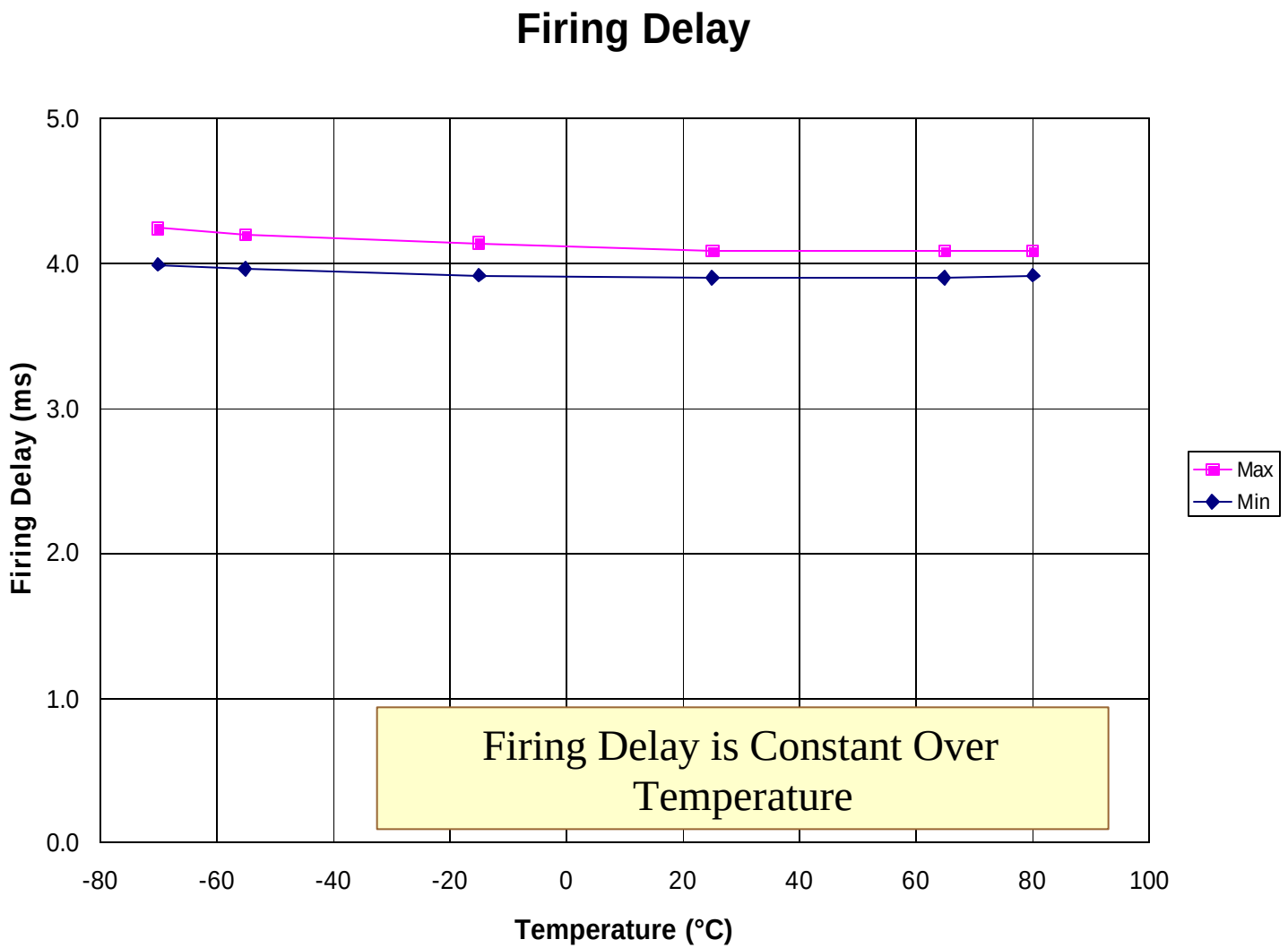

WizOrd™ Program Status

- Prototype System Delivered to NASA
  - One Prototype Bus Controller with PC Based Control Software
  - 10 Initiators
- Validation Test System Delivered to NASA
  - Two Flight Bus Controllers
  - 20 Initiators
  - Validation Test Baseline
    - Thermal Cycle
    - Vibration
    - Shock
    - Thermal Vacuum
    - EMI
    - Salt Fog

WizOrd™ Program Status

- EBA&D Validation Testing
  - Thermal Cycle (-65°F to +165°F)
  - Extended Temperature Testing (-90°F to +170°F)
    - All Performance Characteristics Measured
  - All-Fire at -65°F
  - No-Fire at +160°F
  - Preliminary Conducted EMI (CS101)
  - Fault Simulation
    - Controller Faults
    - Initiator Faults
    - Bus Faults

WizOrd™ Summary

- WizOrd™ Intelligent Initiation System
  - Smaller
  - Lighter
  - Lower Power
  - Flexible
  - More Capable
- Simple Control Interface
- Squib or Detonation Output

- Two Bus Controller Configurations Presently Available
- Extensive Testing Has Been Performed
- Development System Available

WizOrd™ - Enabling Advanced Ordnance Systems